

REMARKS/ARGUMENTS:

I. Status of the Claims

Claims 1, 7, 9, 17 and 20 are amended herein. Claims 1 and 7 have been amended for the purpose of clarifying the subject matter which Applicant intends to claim. Claims 9 and 17 have been amended to conform with the text of claims 1 and 7. No new matter has been introduced. New claim 22 has been added. Support for new claim 22 is found throughout the application as originally filed, including the working examples (e.g., Example 1 describes a gradient copolymer of ethyl acrylate, styrene and methacrylic acid, Example 2a describes a gradient copolymer of styrene, methacrylic acid and butyl acrylate, Example 2b describes a gradient copolymer of styrene, methacrylic acid and methyl acrylate, Example 2c describes a gradient copolymer of styrene, methacrylic acid, butyl acrylate and ethyl acrylate, Example 4 describes a gradient copolymer of ethyl acrylate, methyl acrylate, styrene and methacrylic acid). Claims 3, 5, 6, 8, 12 and 14-16 have been cancelled. As a result, claims 1, 2, 4, 7, 9-11, 13 and 17-22 remain pending and under examination.

II. Claim Rejections - 35 U.S.C. § 112

Applicant traverses the rejection of claims 7, 9, 10 and 20 under 35 U.S.C. § 112, first paragraph, as allegedly failing to comply with the enablement requirement. Reconsideration and withdrawal of the rejection are respectfully requested in view of the claim amendments and arguments presented herein.

Applicant thanks the Examiner for the courtesy of the telephone interview extended to Applicant's legal representative on November 17, 2010, during which the rejections under 35 U.S.C. § 112 were discussed.

As explained in the interview, the embodiment of Applicant's invention which is the subject of claim 7 (from which claims 9, 10 and 20 depend) is directed to a process for producing a gradient copolymer. This process involves polymerizing, in the presence of a radical polymerization initiator and of a specified agent for controlling the polymerization, a mixture of monomers comprising at least two monomers. This mixture contains a first monomer (designated as M₁) and a second monomer (designated as M₂).

The first monomer M_1 is selected such that, when homopolymerized, it provides a homopolymer having a glass transition temperature of less than 20° C. Moreover, the amount of the first monomer M_1 is selected such that it represents at least 50% by weight of the total weight of the monomer mixture. The first monomer M_1 is selected from the Markush group of linear and branched C_1 - C_{12} alkyl acrylates, polyethylene glycol acrylate, polyethylene glycol (meth)acrylate, dienes, butadiene and isoprene.

The second monomer M_2 is selected such that, when homopolymerized, it provides a homopolymer having a glass transition temperature of greater than 20° C. Additionally, the amount of the second monomer M_2 is selected such that it represents at most 50% by weight of the total weight of the monomer mixture. The second monomer M_2 is selected from the Markush group of styrene, styrene derivatives, (meth)acrylic monomers, norbornyl acrylate, methyl methacrylate, acrylonitrile and methacrylonitrile.

Furthermore, in addition to the above-mentioned criteria, at least one of either the first monomer M_1 or the second monomer M_2 must be hydrophilic and selected from the Markush group of polyethylene glycol acrylate, polyethylene glycol methacrylate, acrylic acid and methacrylic acid.

The subject matter of claims 7, 9, 10 and 20 is fully and clearly enabled by the application as originally filed. See, for example, Paragraph [0035] of the application as published (US 2006/0058467):

The first subject matter of the invention is a gradient copolymer comprising at least two monomers, the first (M_1), the homopolymer of which corresponding to a T_{g1} of less than 20° C., represents at least 50% by weight of the total weight of the copolymer, the second (M_2), the homopolymer of which corresponding to a T_{g2} of greater than 20° C. and preferably of greater than 50° C., represents at most 50% by weight of the total weight of the copolymer. Furthermore, at least one of the monomers must be hydrophilic and represent at least 5% by weight of the total weight of the copolymer.

The specification further explains (Paragraphs [0040]-[0042]) that the hydrophilic monomer(s) can be chosen from polyethylene glycol acrylate, polyethylene glycol methacrylate, acrylic acid and methacrylic acid:

The hydrophilic monomers can be chosen from the following monomers, which are spontaneously hydrophilic or which are rendered hydrophilic by simple transformation (quaternization of an amine or neutralization of an acid) in the polymer structure:

ethylenic carboxylic acids, such as acrylic acid, methacrylic acid, itaconic acid or fumaric acid,
acrylates and methacrylates of polyethylene glycol or of glycol which are or are not substituted on their end functional group by alkyl, phosphate, phosphonate or sulfonate groups,

Paragraphs [0049]-[0052] of the specification list certain preferred monomers that can be used as the first monomer M_1 (one type of which is the polyethylene glycol (meth)acrylates, which as explained in Paragraph [0042] can also function as the hydrophilic monomer):

Preferably, M_1 is chosen from the following monomers:

linear or branched C_1 - C_{12} alkyl acrylates,
polyethylene glycol (meth)acrylates,
dienes, such as butadiene or isoprene.

Paragraphs [0053]-[0056] of the specification describe other types of monomers which may be present in the monomer mixture in addition to the hydrophilic monomer(s).

The other monomers participating in the copolymer of the invention are chosen from the following monomers:

styrene derivatives,
(meth)acrylic derivatives resulting in polymers with high T_g values, such as norbornyl acrylate or methyl methacrylate,
acrylonitrile and methacrylonitrile.

The numerous working examples in the application as originally filed provide additional enabling disclosure of the process as claimed in claims 7, 9, 10 and 20. For instance, in Example 1, the bulk synthesis of a gradient copolymer is described which utilizes a monomer mixture containing 80 weight % ethyl acrylate (a linear C_1 - C_{12} alkyl acrylate), 10 weight % styrene and 10 weight % methacrylic acid. In this case, methacrylic acid is the hydrophilic monomer as well as one of the second monomers M_2 (since the homopolymer of methacrylic acid has a T_g greater than 20° C). Ethyl acrylate is the first monomer M_1 (representing at least 50% by weight of the total weight of the monomer mixture, the homopolymer of which has a T_g of less than 20° C). Styrene is an additional monomer M_2 .

For these reasons, Applicant's disclosure, when filed, clearly contained sufficient information regarding the subject matter of the claims as to enable one skilled in the pertinent art to make and use the claimed invention. Any person reasonably skilled in the art could make and use the invention from the disclosures in the application coupled with information

known in the art without undue experimentation. According, the requirements of 35 U.S.C. § 112, first paragraph, have been met.

Applicant traverses the rejection of claims 1, 2, 4, 9-11, 13 and 17-21 under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Reconsideration and withdrawal of the rejection are respectfully requested in view of the claim amendments and arguments presented herein.

In the Office Action mailed September 30, 2010, the Examiner noted that, with respect to claim 1, "the difference between monomers M_1 , M_2 and the hydrophilic monomers is not clear because polyethylene glycol acrylate and polyethylene glycol methacrylate now belong to both monomers M_1 and the hydrophilic monomers while acrylic acid and methacrylic acid belong to both monomers M_2 and the hydrophilic monomers." Page 4, third paragraph. Applicant has now amended the claims in order to further clarify their scope and to address the Examiner's concerns regarding the claim language.

As discussed during the telephone interview and as explained above in connection with the Section 112, first paragraph, rejection, Applicant's invention pertains to gradient copolymers comprising at least two different monomer units, at least one of which is provided by a hydrophilic monomer selected from the group consisting of polyethylene glycol acrylate, polyethylene glycol methacrylate, acrylic acid and methacrylic acid. Furthermore, the monomer units present in the gradient copolymer are selected so as to meet the following additional criteria, as recited in claim 1:

a) the first monomer unit M_1 represents at least 50% by weight of the total weight of the copolymer, with the homopolymer of such monomer unit having a glass transition temperature of less than 20° C and the monomer unit M_1 being furnished by one or more monomers selected from the group consisting of: linear and branched C_1 - C_{12} alkyl acrylates, polyethylene glycol acrylate, polyethylene glycol methacrylate, dienes, butadiene and isoprene;

b) the second monomer unit M_2 represents at most 50% by weight of the total weight of the polymer, with the homopolymer of such monomer unit having a glass transition temperature of more than 20° C and the monomer unit M_2 being furnished by one or more monomers selected from the group consisting of styrene, styrene derivatives, (meth)acrylic

monomers, acrylic acid, methacrylic acid, norbornyl acrylate, methyl methacrylate, acrylonitrile and methacrylonitrile.

A person reasonably skilled in the art would readily understand and appreciate what types of monomer unit combinations would yield gradient copolymers falling within the scope of the claims pending in the application. For example, he or she would recognize that if methacrylic acid is chosen as the sole hydrophilic monomer, the methacrylic acid monomer units produced by copolymerization of the methacrylic acid must represent at least 5% by weight of the total weight of the copolymer. Moreover, since methacrylic acid is included in the second monomer M_2 Markush group recited in claim 1, such ordinarily skilled person would also know that monomer units provided by at least one additional monomer (first monomer M_1) selected from the Markush group of linear and branched C_1 - C_{12} alkyl acrylates, polyethylene glycol acrylate, polyethylene glycol methacrylate, dienes, butadiene and isoprene must also be present in the gradient copolymer, with the amount of such monomer units representing at least 50% by weight of the total weight of the copolymer.

As another example, an ordinarily skilled person would recognize that if polyethylene glycol acrylate is chosen as the sole hydrophilic monomer, the polyethylene glycol acrylate monomer units produced by copolymerization of the polyethylene glycol acrylate must represent at least 5% by weight of the total weight of the copolymer. Moreover, since polyethylene glycol acrylate is included in the first monomer M_1 Markush group recited in claim 1, such ordinarily skilled person would also know that monomer units provided by at least one additional monomer (second monomer M_2) selected from the Markush group of styrene, styrene derivatives, (meth)acrylic monomers, acrylic acid, methacrylic acid, norbornyl acrylate, methyl methacrylate, acrylonitrile and methacrylonitrile must also be present in the gradient copolymer, with the amount of such monomer units M_2 representing at most 50% by weight of the total weight of the copolymer.

Accordingly, Applicant respectfully submits that the scope of the claims, as amended, is sufficiently clear to both inform the public of the boundaries of what constitutes infringement of those claims and to provide a clear measure of what Applicant regards as the invention so that it can be determined whether the claimed invention meets all the criteria for patentability. The claims thus meet the requirements of 35 U.S.C. § 112, second paragraph.

III. Conclusions

Applicant respectfully submits that the application is in condition for allowance and requests early and favorable action thereon. If any issues remain, the Examiner is invited to contact Applicant's legal representative at the telephone number listed below.

Respectfully submitted,

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